PICAV
Personal **I**ntelligent **C**ity **A**ccessible **V**ehicle System

Project Type: 7th FWP

Projet Description :

The proposal presents a new mobility concept for passengers ensuring accessibility for all in urban pedestrian environments. The transport system will ensure accessibility for everybody and some of its features are specifically designed for people whose mobility is restricted for different reasons, particularly (but not only) elderly and disabled people.

Ergonomics, comfort, stability, assisted driving, eco-sustainability, parking and mobility dexterity as well as vehicle/infrastructures intelligent networking are the main drivers of PICAV design.

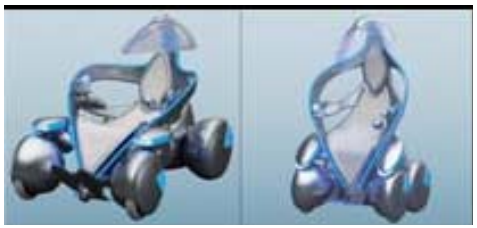
The innovative electrical vehicle will present new frame-suspension structure, new seating sub-assembly, new efficient power supply module. The PICAV transport system will provide an efficient and rational service to citizen within urban traffic restricted areas: the application fields of PICAV are outdoor pedestrian environments where usual public transport services cannot operate because of the width and slope of the infrastructures, uneven pavements and the interactions with high pedestrian flows.

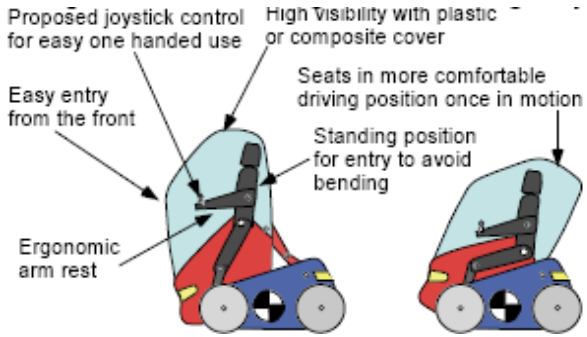
This transport system is on-demand and it is based on the car-sharing concept.

To overcome the barriers of traditional car-sharing systems, the following specific services will be provided: instant access, open-ended reservation, one-way trips.

The single units are networked and can communicate each other, with city infrastructure, public transport on the surrounding area and emergency services allowing high level of intermodal integration.

IMARA TASK: Control and Communication requirements and architecture, Control algorithm, HMI.





Partners & Budgets

Partners Number *	Partners name	Partners short name	Country
1 (coord.)	**DIMEC - University of Genova**	**DIMEC**	**Italy**
2	**INRIA**	**INRIA**	**France**
3	**University College London**	**UCL**	**United Kingdom**
4	**University of Pisa**	**UNIPI**	**Italy**
5	**Serviços Municipalizados de Transportes Colectivos do Barreiro**	**TCB**	**Portugal**
6	**ZTS VVÚ KOŠICE a.s.**	**ZTS**	**Slovakia**
7	**Mazel Ingenieros, S. A.**	**MAZEL**	**Spain**

	RTD / Innovation	Demonstration	Management	Other	Total	Requested EC contribution
DIMEC	661 600	41 280	73 600	33 920	810 400	594 360
INRIA	**621 666**	**50 000**	**26 250**	**44 167**	**742 083**	**561 667**
UCL	397 360	78 032	25 952	43 904	545 248	406 892
UNIPI	441 600	57 280	16 640	25 280	540 800	401 760
TCB	86 400	94 800	6 600	21 000	208 800	139 800
ZTS	419 629	73 307	7 841	21 291	522 068	380 508
MAZEL	391 608	122 982	6 846	47 922	569 358	312 063
	3 019 863	517 681	163 729	237 484	3 938 757	2 797 050

PICAV performance objectives

Objective	**measure/check**
vehicle footprint	Width: 800 mm x Length 1100 mm (+- 20%)
vehicle weight	less than 250 kg
vehicle agility: step overcoming	up to 180 mm
vehicle agility: max incline, max tilt	25 °
vehicle agility: turning radius	1 m
vehicle maximum speed	6 m/s
energy efficiency	improved of more than 25% on market electric vehicles
noise emission	less than 45 dBA
air pollution	zero emission
personal comfort (accessibility and driving)	improved more than 90% for weak users category (reference to average current personal vehicles)
safety	improved more than 65% both for people inside and outside the vehicle (reference to average current personal vehicles)
performance of the transport service	walking distance to PICAV service less than maximum walking distance for elderly; waiting times less than public transport waiting time; PICAV transport demand greater than 80% potential end-users

PICAV performance objectives

- ***Security*:**

  driver recognition system. All critical equipment will be inside the vehicle body and not accessible nor damageable by vandals and users as well (only authorized people should be able to access the equipment). On request, e.g. for security purposes, identity of the passenger can be hidden.

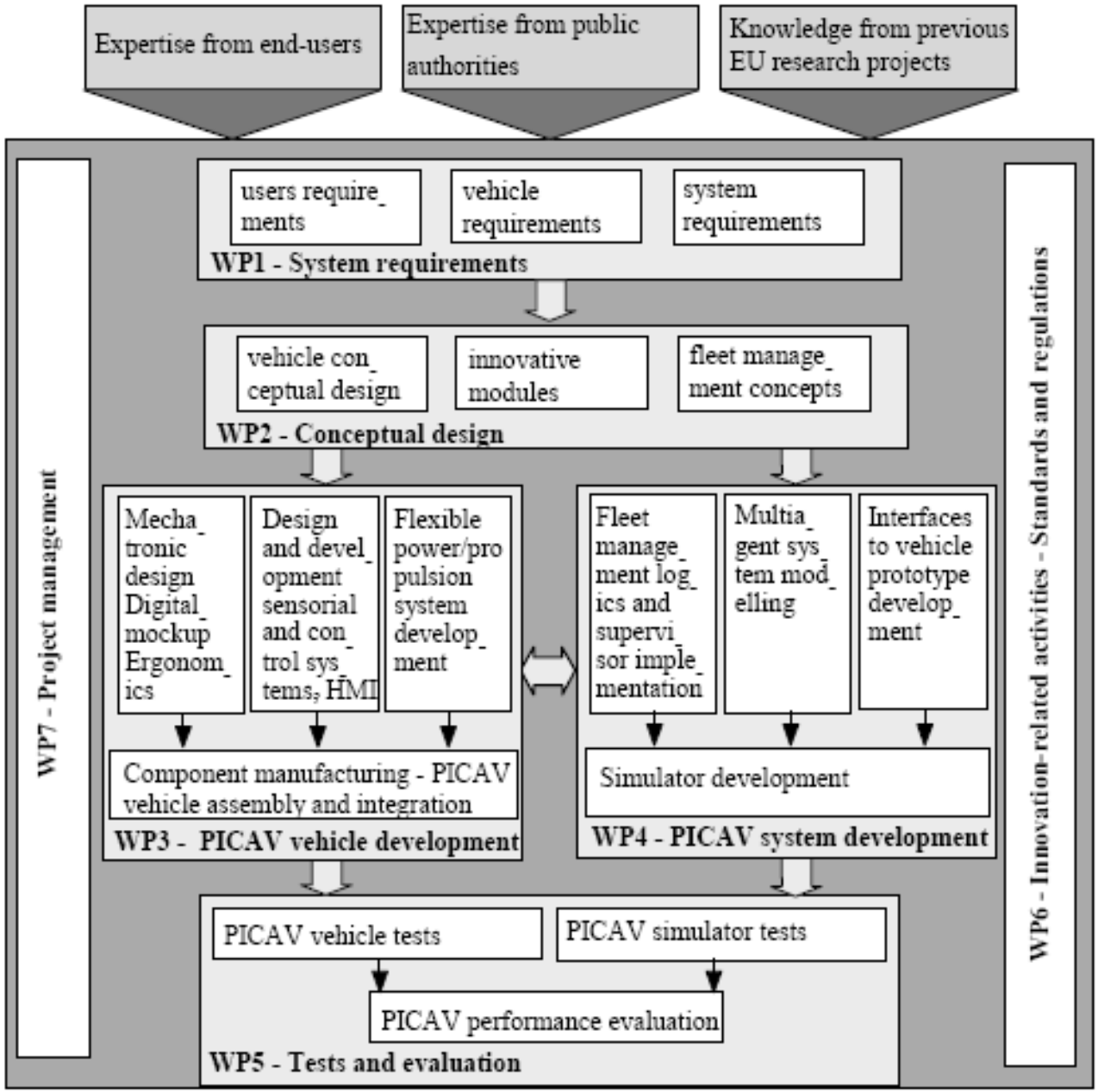
- ***Networking*:**

  the fleet of PICAV will provide a new transport mode which is fully integrated with the urban environment, including traditional public transport, parking, traffic/travel information. Networking and driver support services will be based on and exploit available infrastructures (e.g. GPS positioning, GPRS, UMTS, WiFi in equipped areas, Internet-based information services, etc.) and will take into account forthcoming technologies and services (e.g. GALILEO positioning). Access to on-line information and services will be based on most common traffic telematics standards like e.g. DATEX, Open TIS Access Point (OTAP), RDS/TMC, GDF (ISO14825), etc.

- ***Transport service*:**

  in principle, the benefits of the proposed transport system on the transport service are not quantifiable because nothing similar exists and because of the social value of the service to a category of people usually excluded by the public transport services. The performance of the transport service will be assessed by the following indicators: accessibility as a measure of availability: distance between PICAV parking lots and public transport stops at the border area less then the maximum walking distance for elderly; transport demand as a measure of quality: 80% of the identified potential users will judge satisfactory the simulated transport system (virtual reality testing); waiting times as a measure of reliability: waiting time at the PACAV parking lots comparable with the waiting time at the public transport stops at the border area. As the innovation of the contribution requires the validation of the concepts, the project will realise a vehicle prototype that will be tested first for the aspect of ergonomics and user compliance and satisfaction. Then the capability of interactions with existing mobility infrastructure will be tested in the field in Barreiro (near to Lisbon). In order to evaluate the efficiency of the fleet management in different environmental scenarios as well as the influence of the new transport system on the pedestrian flows and on the pre-existing traffic conditions, a simulator will be purposely written, set-up and delivered.

Structure of the work-plan



WP1 System requirements

Leader TCB		Year 1					Year 2										Year 3																			
		2009					2010										2011												2012							
2 pers/month		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul
WP1																																				
	T 1.1																																			
	T 1.2																																			
	T 1.3																																			

Task 1.1 PICAV user requirements and target user categories representatives:
TCB, in cooperation with the elderly and disabled interested associations headed by LaCruna (DIMEC sub-contractor), will collect data about the potential end-users needs. UNIPI will analyse these data.

Task 1.2 PICAV vehicle requirements:
DIMEC will be in charge of the vehicle mechanics, ergonomic and locomotion dexterity specifications. **INRIA will be in charge of control requirements** and MAZEL of the innovative power system; TCB will define the infrastructures scenarios. UCL will be in charge of accessibility aspects.

Task 1.3 PICAV system requirements:
TCB will be in charge of transport system specifications in general and in particular to the testing reference city centre. UNIPI will perform the preliminary analysis of demand responsive public transport in that area; **INRIA will analyse and discuss the feasibility and characteristics of the networking and communication system.**

WP2 PICAV Conceptual design

Leader MAZEL		Year 1												Year 2												Year 3											
		2009					2010											2011												2012									
14 pers/month		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul
WP2																																					
	T 2.1																																				
	T 2.2																																				
	T 2.3																																				

Task 2.1 PICAV vehicle conceptual design
DIMEC will define the vehicle modular structure and will develop the first check models. **INRIA will specify the sensorial system**. Discussion with MAZEL and ZTS. Support from all other partners and La Cruna sub-contractor.

Task 2.2 PICAV innovative modules conceptual design
DIMEC will define the mechatronic modules architectures. **INRIA will specify the functions and architecture of the sensorial and control systems**; MAZEL will specify the electric power module layout. Support from all partners.

Task 2.3 PICAV system management concepts
TCB will identify constraints related to users needs (accessibility, desired level of service, affordability, etc.); **INRIA will define the architecture of the PICAV system network**. UNIPI and UCL together will define the overall architecture of the simulator; UNIPI will deal with modeling pedestrians, PICAV vehicles and the fleet management; UCL will model the environment, with particular attention to the acc.

WP3 PICAV vehicle development

Leader ZTS		Year 1												Year 2												Year 3											
		2009					2010												2011												2012							
29 pers/month		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul
WP3																																					
	T 3.1																																				
	T 3.2																																				
	T 3.3																																				
	T 3.4																																				

Task 3.1 Innovative modules design and digital mockup
DIMEC will be in charge of vehicle innovative components design, virtual assembly and testing.

Task 3.2 Design and development of sensorial and control systems
INRIA will provide the onboard control system, including redundancy and safety software issues, will develop the drive-by-wire and drive assistant functions, will be responsible of HMI. The partners for mechanical design, actuation and sensing (wheel motors, steering, suspension and cabin) will provide the mechanical components and necessary electronic interfaces to communicate between actuators, sensors and control system (DIMEC, ZTS). The partner in charge of the batteries and power management system (MAZEL) will provide signals to the control system to allow the correct selection of operating modes (full capacity, degenerated modes when low batteries, braking techniques (different if full batteries - no electric braking available- or not)

Task 3.3 Efficient power system development
MAZEL will be responsible for this task. **Support from INRIA for control interfacing**.

Task 3.4 Component manufacturing and PICAV vehicle assembly
All innovative and traditional mechanical components and actuators of the vehicle and the related sensors (as defined in Task 3.2) will be provided by the constructor ZTS with precision components, **INRIA will provide all the control system and extra sensors for obstacle detection and platooning**.

WP4 PICAV system development

Leader UNIPI		Year 1												Year 2												Year 3											
		2009					2010											2011											2012									
8 pers/month		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul
WP4																																					
	T 4.1																																				
	T 4.2																																				
	T 4.3																																				
	T 4.4																																				

Task 4.1 Fleet management
UCL is in charge of the models for the definition of parking lot locations, taking into account accessibility and an efficient exchange with other transport modes; UNIPI is in charge of defining strategies for assessing the fleet dimension and the strategies for re-balancing parked vehicles.

Task 4.2 PICAV multiagent system modeling
UNIPI is in charge of modeling pedestrians and the PICAV vehicles; UCL is in charge of modeling the transport demand, the environment and the exchange of information between the environment and vehicles.

Task 4.3 Interface and networking
INRIA is the main contributor and UNIPI and UCL are in charge of interface with Task 4.2 and Task 4.4 for modeling and implementation of the PICAV operative modes to include within the model and the simulator.

Task 4.4 PICAV simulator development
UNIPI is in charge of writing the code related to the pedestrian description, the PICAV vehicle description and the fleet management strategies; UCL is in charge of writing the code related to the transport demand, the environment description and the exchange of information between the environment and vehicles. **For the tuning of the most critical simulation parameters support from INRIA**, DIMEC and TCB is foreseen.

WP5 Test and Evaluation

Leader UCL		Year 1												Year 2												Year 3											
		2009					2010											2011												2012								
5 pers/month		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul
WP5																																					
	T 5.1																																				
	T 5.2																																				
	T 5.3																																				

Task 5.1 PICAV modules and vehicle tests
This task involves all the partners but the main roles are attributed to ZTS and MAZEL; **support from TCB, DIMEC(La Cruna) and INRIA**.

Task 5.2 PICAV simulator tests
The task leader is UCL, UNIPI is mainly involved; supporting role from TCB and INRIA.

Task 5.3 PICAV performance evaluation
The evaluation team assessing and discussing the PICAV paradigms is led by MAZEL and involves mainly ZTS, UCL, UNIPI. Support will be given from other partners and associations.

WP6 Innovation related activities. Standards and regulations

Leader **INRIA**		Year 1												Year 2												Year 3											
		2009					2010												2011												2012							
4 pers/month		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul
WP6																																					
	T 6.1																																				
	T 6.2																																				
	T 6.3																																				
	T 6.4																																				
	T 6.5																																				

The main partners are TCB and UCL for socio economic aspects, industrial partners (ZTS, MAZEL) for marketing strategy and results exploitation, academic partners (DIMEC, UCL, UNIPI) for dissemination activities.

Task 6.1 Protection IPR

Task 6.2 Socio-economic aspects

Task 6.3 Marketing strategy and feedback

Task 6.4 Dissemination, training and exploitation

Task 6.5 Standards and regulations

WP7 Project management

Leader DIMEC		Year 1					Year 2										Year 3																		
		2009					2010											2011												2012						
2 pers/month		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mai	Jun	Jul
WP7																																				
	T 7.1																																			
	T 7.2																																			
	T 7.3																																			
	T 7.4																																			

Task 7.1 Organizational, administrative and financial coordination

Task 7.2 Scientific and technological project management

Task 7.3 Supervision of project progress

Task 7.4 Corrective actions and conflict resolution

Work Packages

Workpackage	**WP1**	**WP2**	**WP3**	**WP4**	**WP5**	**WP6**	**WP7**	**TOTAL per Beneficiary**
DIMEC	7	25	45	8	6	4	10	105
INRIA	2	14	29	8	5	4	2	64
UCL	3	6	1	25	7	4	2	48
UNIPI	5	19	7	39	9	4	2	85
TCB	9	5	4	4	25	7	1	55
ZTS	4	15	47	2	17	7	1	93
MAZEL	5	10	29	4	17	7	1	73
TOTAL	35	94	162	90	86	37	19	523

Work package No	**Work package title**	**Type of activity**	**Lead beneficiary No**	**Person-months**	**Start month**	**End month**
WP 1	**System requirements**	RTD	5	35	1	5
WP 2	**PICAV conceptual design**	RTD	7	94	5	9
WP 3	**PICAV vehicle development**	RTD	6	162	9	27
WP 4	**PICAV system development**	RTD	4	90	9	31
WP 5	**Tests and evaluation**	DEM	3	86	24	36
WP 6	**Innovation related activities - Standards**	OTHER	2	37	5	36
WP 7	**Project Management**	MGT	1	19	1	36
	TOTAL			523		